



## SEQUENCE LISTING

<110> Nicolaides, Nicholas  
Sass, Philip  
Grasso, Luigi  
Vogelstein, Bert  
Kinzler, Kenneth

<130> 01107.00100

<141> 2001-02-12

<150> 60/181,929

<151> 2000-02-11

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<213> Homo sapiens

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Lys	Leu	Gln	Lys	Phe 85	Glu	Asp	Leu	Ser	Gln 90	Ile	Gln	Thr	Tyr	Gly 95	Phe
Arg	Gly	Glu	Ala	Leu 100	Ala	Ser	Ile	Ser 105	His	Val	Ala	Arg	Val 110	Thr	Val
Thr	Thr	Lys 115	Val	Lys	Glu	Asp 120	Arg	Cys	Ala	Trp	Arg	Val 125	Ser	Tyr	Ala
Glu	Gly 130	Lys	Met	Leu	Glu	Ser 135	Pro	Lys	Pro	Val	Ala 140	Gly	Lys	Asp	Gly
Thr 145	Thr	Ile	Leu	Val	Glu 150	Asp	Leu	Phe	Phe	Asn 155	Ile	Pro	Ser	Arg	Leu 160
Arg	Ala	Leu	Arg	Ser 165	His	Asn	Asp	Glu	Tyr 170	Ser	Lys	Ile	Leu	Asp 175	Val
Val	Gly	Arg	Tyr 180	Ala	Ile	His	Ser	Lys 185	Asp	Ile	Gly	Phe	Ser 190	Cys	Lys
Lys	Phe	Gly 195	Asp	Ser	Asn	Tyr	Ser 200	Leu	Ser	Val	Lys	Pro 205	Ser	Tyr	Thr
Val	Gln 210	Asp	Arg	Ile	Arg	Thr 215	Val	Phe	Asn	Lys	Ser 220	Val	Ala	Ser	Asn
Leu 225	Ile	Thr	Phe	His	Ile 230	Ser	Lys	Val	Glu	Asp 235	Leu	Asn	Leu	Glu	Ser 240
Val	Asp	Gly	Lys	Val 245	Cys	Asn	Leu	Asn	Phe 250	Ile	Ser	Lys	Lys	Ser 255	Ile
Ser	Leu	Ile	Phe 260	Phe	Ile	Asn	Asn	Arg 265	Leu	Val	Thr	Cys	Asp 270	Leu	Leu
Arg	Arg	Ala 275	Leu	Asn	Ser	Val	Tyr 280	Ser	Asn	Tyr	Leu	Pro 285	Lys	Gly	Phe
Arg	Pro 290	Phe	Ile	Tyr	Leu	Gly 295	Ile	Val	Ile	Asp	Pro 300	Ala	Ala	Val	Asp
Val 305	Asn	Val	His	Pro	Thr 310	Lys	Arg	Glu	Val	Arg 315	Phe	Leu	Ser	Gln	Asp 320
Glu	Ile	Ile	Glu	Lys 325	Ile	Ala	Asn	Gln	Leu	His	Ala	Glu	Leu	Ser 335	Ala
Ile	Asp	Thr	Ser 340	Arg	Thr	Phe	Lys	Ala 345	Ser	Ser	Ile	Ser	Thr 350	Asn	Lys
Pro	Glu	Ser 355	Leu	Ile	Pro	Phe	Asn 360	Asp	Thr	Ile	Glu	Ser 365	Asp	Arg	Asn
Arg	Lys 370	Ser	Leu	Arg	Gln	Ala 375	Gln	Val	Val	Glu	Asn 380	Ser	Tyr	Thr	Thr
Ala 385	Asn	Ser	Gln	Leu	Arg 390	Lys	Ala	Lys	Arg	Gln 395	Glu	Asn	Lys	Leu	Val 400
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Gln	Gln	Phe	Asn 420	Phe	Glu	Gly	Ser	Ser 425	Thr	Lys	Arg	Gln 430	Leu	Ser	Glu
Pro	Lys 435	Val	Thr	Asn	Val	Ser	His 440	Ser	Gln	Glu	Ala 445	Glu	Lys	Leu	Thr
Leu	Asn 450	Glu	Ser	Glu	Gln	Pro 455	Arg	Asp	Ala	Asn 460	Thr	Ile	Asn	Asp	Asn
Asp 465	Leu	Lys	Asp	Gln	Pro 470	Lys	Lys	Lys	Gln	Lys 475	Leu	Gly	Asp	Tyr	Lys 480
Val	Pro	Ser	Ile	Ala 485	Asp	Asp	Glu	Lys	Asn 490	Ala	Leu	Pro	Ile	Ser 495	Lys
Asp	Gly	Tyr	Ile 500	Arg	Val	Pro	Lys	Glu 505	Arg	Val	Asn	Val 510	Asn	Leu	Thr
Ser	Ile 515	Lys	Lys	Leu	Arg	Glu	Lys 520	Val	Asp	Asp	Ser	Ile 525	His	Arg	Glu
Leu	Thr 530	Asp	Ile	Phe	Ala	Asn 535	Leu	Asn	Tyr	Val	Gly 540	Val	Val	Asp	Glu
Glu	Arg	Arg	Leu	Ala	Ala	Ile	Gln	His	Asp	Leu	Lys	Leu	Phe	Leu	Ile

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 Asp Tyr Gly Ser Val Cys Tyr Glu Leu Phe Tyr Gln Ile Gly Leu Thr  
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 Asp Phe Ala Asn Phe Gly Lys Ile Asn Leu Gln Ser Thr Asn Val Ser  
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 Asp Asp Ile Val Leu Tyr Asn Leu Leu Ser Glu Phe Asp Glu Leu Asn  
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 Asp Asp Ala Ser Lys Glu Lys Ile Ile Ser Lys Ile Trp Asp Met Ser  
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 Ser Met Leu Asn Glu Tyr Ser Ile Glu Leu Val Asn Asp Gly Leu  
 625                                   630                      635                      640  
 Asp Asn Asp Leu Lys Ser Val Lys Leu Lys Ser Leu Pro Leu Leu Leu  
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 Lys Gly Tyr Ile Pro Ser Leu Val Lys Leu Pro Phe Phe Ile Tyr Arg  
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 Leu Gly Lys Glu Val Asp Trp Glu Asp Glu Gln Glu Cys Leu Asp Gly  
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 Ile Leu Arg Glu Ile Ala Leu Tyr Ile Pro Asp Met Val Pro Lys  
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 Val Asp Thr Leu Asp Ala Ser Leu Ser Glu Asp Glu Lys Ala Gln Phe  
 705                                   710                      715                      720  
 Ile Asn Arg Lys Glu His Ile Ser Ser Leu Leu Glu His Val Leu Phe  
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 Pro Cys Ile Lys Arg Arg Phe Leu Ala Pro Arg His Ile Leu Lys Asp  
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 Cys

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 Leu Ser Leu Ser Thr Ala Val Lys Glu Leu Ile Glu Asn Ser Val Asp  
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 Ala Gly Ala Thr Thr Ile Asp Leu Arg Leu Lys Asp Tyr Gly Val Asp  
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 Leu Ile Glu Val Ser Asp Asn Gly Cys Gly Val Glu Glu Glu Asn Phe  
 65                                   70                                   75                                   80  
 Glu Gly Leu Ala Leu Lys His His Thr Ser Lys Ile Gln Glu Phe Ala  
                                  85                                   90                                   95  
 Asp Leu Thr Gln Val Glu Thr Phe Gly Phe Arg Gly Glu Ala Leu Ser  
                                  100                                   105                                   110  
 Ser Leu Cys Ala Leu Ser Asp Val Thr Ile Ser Thr Cys His Gly Ser  
                                  115                                   120                                   125  
 Ala Ser Val Gly Thr Arg Leu Val Phe Asp His Asn Gly Lys Ile Thr  
                                  130                                   135                                   140  
 Gln Lys Thr Pro Tyr Pro Arg Pro Lys Gly Thr Thr Val Ser Val Gln  
 145                                   150                                   155                                   160  
 His Leu Phe Tyr Thr Leu Pro Val Arg Tyr Lys Glu Phe Gln Arg Asn  
                                  165                                   170                                   175  
 Ile Lys Lys Glu Tyr Ser Lys Met Val Gln Val Leu Gln Ala Tyr Cys

007806706404

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Ile	Ile	Ser	Ala	Gly	Val	Arg	Val	Ser	Cys	Thr	Asn	Gln	Leu	Gly	Gln	
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Gly	Lys	Arg	His	Ala	Val	Val	Cys	Thr	Ser	Gly	Thr	Ser	Gly	Met	Lys	
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Glu	Asn	Ile	Gly	Ser	Val	Phe	Gly	Gln	Lys	Gln	Leu	Gln	Ser	Leu	Ile	
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Pro	Phe	Val	Gln	Leu	Pro	Pro	Ser	Asp	Ala	Val	Cys	Glu	Glu	Tyr	Gly	
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Leu	Ser	Thr	Ser	Gly	Arg	His	Lys	Thr	Phe	Ser	Thr	Phe	Arg	Ala	Ser	
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Phe	His	Ser	Ala	Arg	Thr	Ala	Pro	Gly	Gly	Val	Gln	Gln	Thr	Gly	Ser	
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Phe	Ser	Ser	Ser	Ile	Arg	Gly	Pro	Val	Thr	Gln	Gln	Arg	Ser	Leu	Ser	
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Leu	Ser	Met	Arg	Phe	Tyr	His	Met	Tyr	Asn	Arg	His	Gln	Tyr	Pro	Phe	
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Val	Val	Leu	Asn	Val	Ser	Val	Asp	Ser	Glu	Cys	Val	Asp	Ile	Asn	Val	
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Thr	Pro	Asp	Lys	Arg	Gln	Ile	Leu	Leu	Gln	Glu	Glu	Lys	Leu	Leu	Leu	
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Ala	Val	Leu	Lys	Thr	Ser	Leu	Ile	Gly	Met	Phe	Asp	Ser	Asp	Ala	Asn	
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	370					375					380					
Val	Lys	Leu	His	Thr	Ala	Glu	Leu	Glu	Lys	Pro	Val	Pro	Gly	Lys	Gln	
385					390					395					400	
Asp	Asn	Ser	Pro	Ser	Leu	Lys	Ser	Thr	Ala	Asp	Glu	Lys	Arg	Val	Ala	
				405					410					415		
Ser	Ile	Ser	Arg	Leu	Arg	Glu	Ala	Phe	Ser	Leu	His	Pro	Thr	Lys	Glu	
			420					425					430			
Ile	Lys	Ser	Arg	Gly	Pro	Glu	Thr	Ala	Glu	Leu	Thr	Arg	Ser	Phe	Pro	
		435					440					445				
Ser	Glu	Lys	Arg	Gly	Val	Leu	Ser	Ser	Tyr	Pro	Ser	Asp	Val	Ile	Ser	
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Tyr	Arg	Gly	Leu	Arg	Gly	Ser	Gln	Asp	Lys	Leu	Val	Ser	Pro	Thr	Asp	
465					470					475					480	
Ser	Pro	Gly	Asp	Cys	Met	Asp	Arg	Glu	Lys	Ile	Glu	Lys	Asp	Ser	Gly	
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Leu	Ser	Ser	Thr	Ser	Ala	Gly	Ser	Glu	Glu	Glu	Phe	Ser	Thr	Pro	Glu	
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Val	Ala	Ser	Ser	Phe	Ser	Ser	Asp	Tyr	Asn	Val	Ser	Ser	Leu	Glu	Asp	
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Arg	Pro	Ser	Gln	Glu	Thr	Ile	Asn	Cys	Gly	Asp	Leu	Asp	Cys	Arg	Pro	
	530					535					540	</				

# THESE



Ala	Leu	Met	Ser	Val	Leu	Gly	Thr	Ala	Val	Met	Asn	Asn	Met	Glu	Ser
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Phe	Gln	Tyr	His	Ser	Glu	Glu	Ser	Gln	Ile	Tyr	Leu	Ser	Gly	Phe	Leu
225					230					235					240
Pro	Lys	Cys	Asp	Ala	Asp	His	Ser	Phe	Thr	Ser	Leu	Ser	Thr	Pro	Glu
				245					250					255	
Arg	Ser	Phe	Ile	Phe	Ile	Asn	Ser	Arg	Pro	Val	His	Gln	Lys	Asp	Ile
			260					265					270		
Leu	Lys	Leu	Ile	Arg	His	His	Tyr	Asn	Leu	Lys	Cys	Leu	Lys	Glu	Ser
		275					280					285			
Thr	Arg	Leu	Tyr	Pro	Val	Phe	Phe	Leu	Lys	Ile	Asp	Val	Pro	Thr	Ala
	290					295					300				
Asp	Val	Asp	Val	Asn	Leu	Thr	Pro	Asp	Lys	Ser	Gln	Val	Leu	Leu	Gln
305					310					315					320
Asn	Lys	Glu	Ser	Val	Leu	Ile	Ala	Leu	Glu	Asn	Leu	Met	Thr	Thr	Cys
				325					330					335	
Tyr	Gly	Pro	Leu	Pro	Ser	Thr	Asn	Ser	Tyr	Glu	Asn	Asn	Lys	Thr	Asp
			340					345					350		
Val	Ser	Ala	Ala	Asp	Ile	Val	Leu	Ser	Lys	Thr	Ala	Glu	Thr	Asp	Val
		355					360					365			
Leu	Phe	Asn	Lys	Val	Glu	Ser	Ser	Gly	Lys	Asn	Tyr	Ser	Asn	Val	Asp
	370					375					380				
Thr	Ser	Val	Ile	Pro	Phe	Gln	Asn	Asp	Met	His	Asn	Asp	Glu	Ser	Gly
385					390					395					400
Lys	Asn	Thr	Asp	Asp	Cys	Leu	Asn	His	Gln	Ile	Ser	Ile	Gly	Asp	Phe
				405					410					415	
Gly	Tyr	Gly	His	Cys	Ser	Ser	Glu	Ile	Ser	Asn	Ile	Asp	Lys	Asn	Thr
			420					425					430		
Lys	Asn	Ala	Phe	Gln	Asp	Ile	Ser	Met	Ser	Asn	Val	Ser	Trp	Glu	Asn
		435					440					445			
Ser	Gln	Thr	Glu	Tyr	Ser	Lys	Thr	Cys	Phe	Ile	Ser	Ser	Val	Lys	His
	450					455					460				
Thr	Gln	Ser	Glu	Asn	Gly	Asn	Lys	Asp	His	Ile	Asp	Glu	Ser	Gly	Glu
465					470					475					480
Asn	Glu	Glu	Glu	Ala	Gly	Leu	Glu	Asn	Ser	Ser	Glu	Ile	Ser	Ala	Asp
				485					490					495	
Glu	Trp	Ser	Arg	Gly	Asn	Ile	Leu	Lys	Asn	Ser	Val	Gly	Glu	Asn	Ile
			500					505					510		
Glu	Pro	Val	Lys	Ile	Leu	Val	Pro	Glu	Lys	Ser	Leu	Pro	Cys	Lys	Val
		515					520					525			
Ser	Asn	Asn	Asn	Tyr	Pro	Ile	Pro	Glu	Gln	Met	Asn	Leu	Asn	Glu	Asp
	530					535					540				
Ser	Cys	Asn	Lys	Lys	Ser	Asn	Val	Ile	Asp	Asn	Lys	Ser	Gly	Lys	Val
545					550					555					560
Thr	Ala														

[illegible]



[illegible]





Gln	Tyr	Arg	Val	Glu	Val	Tyr	Lys	Asn	Arg	Ala	Gly	Asn	Lys	Ala	Ser		
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Lys	Glu	Asn	Asp	Trp	Tyr	Leu	Ala	Tyr	Lys	Ala	Ser	Pro	Gly	Asn	Leu		
		115					120					125					
Ser	Gln	Phe	Glu	Asp	Ile	Leu	Phe	Gly	Asn	Asn	Asp	Met	Ser	Ala	Ser		
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Ile	Gly	Val	Val	Gly	Val	Lys	Met	Ser	Ala	Val	Asp	Gly	Gln	Arg	Gln		
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Val	Gly	Val	Gly	Tyr	Val	Asp	Ser	Ile	Gln	Arg	Lys	Leu	Gly	Leu	Cys		
			165					170						175			
Glu	Phe	Pro	Asp	Asn	Asp	Gln	Phe	Ser	Asn	Leu	Glu	Ala	Leu	Leu	Ile		
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Gln	Ile	Gly	Pro	Lys	Glu	Cys	Val	Leu	Pro	Gly	Gly	Glu	Thr	Ala	Gly		
	195					200						205					
Asp	Met	Gly	Lys	Leu	Arg	Gln	Ile	Ile	Gln	Arg	Gly	Gly	Ile	Leu	Ile		
	210					215					220						
Thr	Glu	Arg	Lys	Lys	Ala	Asp	Phe	Ser	Thr	Lys	Asp	Ile	Tyr	Gln	Asp		
225					230					235					240		
Leu	Asn	Arg	Leu	Leu	Lys	Gly	Lys	Lys	Gly	Glu	Gln	Met	Asn	Ser	Ala		
			245						250					255			
Val	Leu	Pro	Glu	Met	Glu	Asn	Gln	Val	Ala	Val	Ser	Ser	Leu	Ser	Ala		
			260				265						270				
Val	Ile	Lys	Phe	Leu	Glu	Leu	Leu	Ser	Asp	Asp	Ser	Asn	Phe	Gly	Gln		
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Phe	Glu	Leu	Thr	Thr	Phe	Asp	Phe	Ser	Gln	Tyr	Met	Lys	Leu	Asp	Ile		
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Ala	Ala	Val	Arg	Ala	Leu	Asn	Leu	Phe	Gln	Gly	Ser	Val	Glu	Asp	Thr		
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Thr	Gly	Ser	Gln	Ser	Leu	Ala	Ala	Leu	Leu	Asn	Lys	Cys	Lys	Thr	Pro		
			325						330					335			
Gln	Gly	Gln	Arg	Leu	Val	Asn	Gln	Trp	Ile	Lys	Gln	Pro	Leu	Met	Asp		
			340				345						350				
Lys	Asn	Arg	Ile	Glu	Glu	Arg	Leu	Asn	Leu	Val	Glu	Ala	Phe	Val	Glu		
	355						360					365					
Asp	Ala	Glu	Leu	Arg	Gln	Thr	Leu	Gln	Glu	Asp	Leu	Leu	Arg	Arg	Phe		
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Pro	Asp	Leu	Asn	Arg	Leu	Ala	Lys	Lys	Phe	Gln	Arg	Gln	Ala	Ala	Asn		
385					390					395					400		
Leu	Gln	Asp	Cys	Tyr	Arg	Leu	Tyr	Gln	Gly	Ile	Asn	Gln	Leu	Pro	Asn		
			405						410				415				
Val	Ile	Gln	Ala	Leu	Glu	Lys	His	Glu	Gly	Lys	His	Gln	Lys	Leu	Leu		
		420						425					430				
Leu	Ala	Val	Phe	Val	Thr	Pro	Leu	Thr	Asp	Leu	Arg	Ser	Asp	Phe	Ser		
		435					440					445					
Lys	Phe	Gln	Glu	Met	Ile	Glu	Thr	Thr	Leu	Asp	Met	Asp	Gln	Val	Glu		
	450					455					460						
Asn	His	Glu	Phe	Leu	Val	Lys	Pro	Ser	Phe	Asp	Pro	Asn	Leu	Ser	Glu		
465					470					475					480		
Leu	Arg	Glu	Ile	Met	Asn	Asp	Leu	Glu	Lys	Lys	Met	Gln	Ser	Thr	Leu		
			485						490					495			
Ile	Ser	Ala	Ala	Arg	Asp	Leu	Gly	Leu	Asp	Pro	Gly	Lys	Gln	Ile	Lys		
		500						505					510				
Leu	Asp	Ser	Ser	Ala	Gln	Phe	Gly	Tyr	Tyr	Phe	Arg	Val	Thr	Cys	Lys		
		515					520					525					
Glu	Glu	Lys	Val	Leu	Arg	Asn	Asn	Lys	Asn	Phe	Ser	Thr	Val	Asp	Ile		
	530					535					540						
Gln	Lys	Asn	Gly	Val	Lys	Phe	Thr	Asn	Ser	Lys	Leu	Thr	Ser	Leu	Asn		
545					550					555					560		
Glu	Glu	Tyr	Thr	Lys	Asn	Lys	Thr	Glu	Tyr	Glu	Glu	Ala	Gln	Asp	Ala		

100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510 520 530 540 550 560

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		595					600					605			
Ala	His	Val	Ser	Asn	Gly	Ala	Pro	Val	Pro	Tyr	Val	Arg	Pro	Ala	Ile
	610					615					620				
Leu	Glu	Lys	Gly	Gln	Gly	Arg	Ile	Ile	Leu	Lys	Ala	Ser	Arg	His	Ala
625					630					635				640	
Cys	Val	Glu	Val	Gln	Asp	Glu	Ile	Ala	Phe	Ile	Pro	Asn	Asp	Val	Tyr
				645					650					655	
Phe	Glu	Lys	Asp	Lys	Gln	Met	Phe	His	Ile	Ile	Thr	Gly	Pro	Asn	Met
			660					665					670		
Gly	Gly	Lys	Ser	Thr	Tyr	Ile	Arg	Gln	Thr	Gly	Val	Ile	Val	Leu	Met
		675					680					685			
Ala	Gln	Ile	Gly	Cys	Phe	Val	Pro	Cys	Glu	Ser	Ala	Glu	Val	Ser	Ile
	690					695					700				
Val	Asp	Cys	Ile	Leu	Ala	Arg	Val	Gly	Ala	Gly	Asp	Ser	Gln	Leu	Lys
705					710					715				720	
Gly	Val	Ser	Thr	Phe	Met	Ala	Glu	Met	Leu	Glu	Thr	Ala	Ser	Ile	Leu
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Arg	Ser	Ala	Thr	Lys	Asp	Ser	Leu	Ile	Ile	Ile	Asp	Glu	Leu	Gly	Arg
			740					745					750		
Gly	Thr	Ser	Thr	Tyr	Asp	Gly	Phe	Gly	Leu	Ala	Trp	Ala	Ile	Ser	Glu
		755					760					765			
Tyr	Ile	Ala	Thr	Lys	Ile	Gly	Ala	Phe	Cys	Met	Phe	Ala	Thr	His	Phe
	770					775					780				
His	Glu	Leu	Thr	Ala	Leu	Ala	Asn	Gln	Ile	Pro	Thr	Val	Asn	Asn	Leu
785					790					795				800	
His	Val	Thr	Ala	Leu	Thr	Thr	Glu	Glu	Thr	Leu	Thr	Met	Leu	Tyr	Gln
			805						810				815		
Val	Lys	Lys	Gly	Val	Cys	Asp	Gln	Ser	Phe	Gly	Ile	His	Val	Ala	Glu
			820					825					830		
Leu	Ala	Asn	Phe	Pro	Lys	His	Val	Ile	Glu	Cys	Ala	Lys	Gln	Lys	Ala
		835					840					845			
Leu	Glu	Leu	Glu	Glu	Phe	Gln	Tyr	Ile	Gly	Glu	Ser	Gln	Gly	Tyr	Asp
	850					855				860					
Ile	Met	Glu	Pro	Ala	Ala	Lys	Lys	Cys	Tyr	Leu	Glu	Arg	Glu	Gln	Gly
865					870					875				880	
Glu	Lys	Ile	Ile	Gln	Glu	Phe	Leu	Ser	Lys	Val	Lys	Gln	Met	Pro	Phe
				885					890					895	
Thr	Glu	Met	Ser	Glu	Glu	Asn	Ile	Thr	Ile	Lys	Leu	Lys	Gln	Leu	Lys
			900					905					910		
Ala	Glu	Val	Ile	Ala	Lys	Asn	Asn	Ser	Phe	Val	Asn	Glu	Ile	Ile	Ser
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 Lys Glu Met Ile Glu Asn Cys Leu Asp Ala Lys Ser Thr Ser Ile Gln



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His	Tyr	Ala	Ile	Asn											

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**THE** **WORLD'S** **LARGEST** **BOOK** **STORE**

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Met Asn Thr Leu Gln Gly Pro Val Ser Phe Lys Asp Val Ala Val Asp  
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